Journal of Crop and Weed, ***9****(1):79-82(2013)*

Effect of organic farming on organic carbon and NPK status of soil in Northern Karnataka,India

G.R. MANJUNATHA, K.V. ASHALATHA, [1]K. R. PATIL AND K.P. VISHWAJITH

Department of Agrilcultural Statistics
[1]Department of Agrilcultural Economics
UAS, Dharwad-580005, Karnataka

Received: 17-1-2013, Revised: 23-4-2013, Accepted: 30-4-2013

ABSTRACT

Increasing consciousness about environmental degradation as well as health hazards caused by inorganic farming and consumer's preference to residue free food are the major concern that have led to the mounting interest in alternate forms of agriculture (Organic farming) worldwide. Hence, present study was conducted with the object to determine the effect of years of practicing organic farming on the status of various soil health indicators by using analysis of variance technique (ANOVA) in the selected Agro Climatic Zones of Northern Karnataka. Data for the analysis was elicited from organic farmers' selected based on multistage purposive random sampling method. The study revealed the significant influence of years of practicing organic farming on various soil health indicators, signaled through highly significant F- ratio. Thus, it can be concluded that by practicing organic agriculture the soil health can be enhanced meanwhile environmental pollution can be reduced.

Keywords: Agro climatic zones, organic carbon, soil health indicators

Budding awareness about the health hazards and environmental degradation due to inorganic agriculture and mounting demand for residue free food among the consumers has led to the transition in cultivation pattern in agriculture from inorganic to organic or integration of both worldwide. Globally, around 141 countries produce certified organic products in commercial quantities. According to the latest survey on organic agriculture, carried out by the Research Institute of Organic Agriculture (FiBL), and International Federation of Organic Agriculture Movements (IFOMA), there is a 32.2 million hectares of land is under pure organic agriculture (Anon., 2010).

In India, 9.2 m ha of area is being under organic farming out of which 1.2 m. ha is cultivated area while remaining 8.0 m ha is wild forest harvest collection area. India holds 7^{th} and 2^{nd} position in the world in terms of area and number of producers involved in organic farming respectively with a production of 9,76,000 tonnes of certified organic products, which includes all varieties of food products and certain non-food products with a market trade share of 0.25% of world organic market. In Karnataka, 19,243 farmers are involved in organic cultivation with an area of 0.022 m ha (Yadav, 2009).

Organic production systems rely more on the use of on-farm inputs and less on external inputs, emphasizes ecological sustainability (Behera *et al.,* 2012). Thus by organic agriculture, the use of synthetics can be reduced and environmental degradation can be curtailed. Considering the potential environmental benefits and its compatibility with integrated agricultural approaches to rural development. In India, only 30% of the cultivable areas having assured irrigation facility are intensively cultivated with heavy dependence on chemical fertilizer while the remaining 70% of the arable lands are rainfed and a meager amount of fertilizers is used making organic agriculture indispensable in these areas (http://www.organicfacts.net).

Organic farming has expanded rapidly in recent years and is seen as a sustainable alternative to chemical-based agricultural systems (Stockdale *et al*., 2001; Biao *et al*., 2003; Avery, 2007). Its annual growth rate has been about 20% for the last decade (Lotter, 2003), generating over 26 billion US dollars in annual trade worldwide (Yussefi, 2006). Nutrient management in organic farming systems is often based on soil fertility building via nitrogen (N) fixation and nutrient recycling of organic materials, such as farmyard manure and crop residues, with limited inputs from permitted fertilizers (Gosling and Shepherd, 2005). Although organic farming has been criticized for relying on the build-up of soil phosphorus (P) and potassium (K) by past fertilization before converting to organic (Nguyen *et al*., 1995; Greenland, 2000; Loes and Ogaard, 2001), its acceptance and popularity are growing due mostly to environmental and health related concerns (Biao *et al*., 2003; Galantini and Rosell, 2006). A recent polling of residents of Ontario, Canada reveals that more than half think organic food is more nutritious; two-thirds believe organic food is safer than conventionally grown food; and 9 out of 10 believe organic fruits and vegetables are grown without pesticides of any kind (Avery, 2007). Thus organic agriculture may be considered as a best alternative and developmental vehicle for developing countries like India. Therefore, the present study attempts to determine the effect of years of practicing organic

Email: mgr.dvg@gmail.com

farming on OC and NPK status of soil in the selected Agro-Climatic Zones of Northern Karnataka.

MATERIALS AND METHODS

The sample data is elicited based on multistage purposive sampling. Three zones namely, Hilly zone, Northern transitional zone and Northern dry zone were chosen to represent distinct agro climatic situation of Northern Karnataka. Based on average annual rainfall received *i.e*. high (>1150 mm), medium (750-1150 mm) and low(<750 mm), respectively, three districts *viz*., Uttar Kannada, Dharwad and Bijapur districts were chosen from the selected zones. One taluk and two villages having maximum number of organic growers were selected to represent the chosen districts. The sample respondents were selected on the basis of the list of organic cultivators provided by the Institute of Organic Farming (IOF), UAS, Dharwad. Total sample size of 75 comprised 25 organic farmers selected from each zone. Data pertinent to the study was elicited using well-structured schedule. To assess the impact of organic farming on soil health indicators, soil samples are collected from three categories of farmers based on the number of years of practicing organic farming (five, ten and fifteen years) in all of the selected zones.

The proposed hypothesis that the status of various soil health indicators (organic carbon, nitrogen, phosphorus and potassium content) improved with period of practicing organic farming in study area, was tested through ANOVA.

Factorial Complete Randomized Design (CRD) with zones and years as factors was carried out. Mathematical representation of the model is given as,

$$Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \varepsilon_{ijk}$$

$$i = 1,2,...,\ a$$

$$j = 1,2,...,\ b$$

$$k = 1,2,...,\ n$$

Where,

μ: Over all mean,

y_{ijk} **:** The kth observed value of jth year in the ith zone,

α_i **:** Effect of soil indicators content in ith zone,

β_j **:** Effect of soil indicators content in jth year,

$(\alpha\beta)_{ij}$ **:** Interaction effect of jth year in the ith zone,

ε_{ijk} **:** Random error.

RESULTS AND DISCUSSION

The ANOVA technique employed facilitated to delineation of the variation caused by various organic farming practices performed over a period of time on status of various soil health indicators such as organic carbon, nitrogen, phosphorus and potassium and in the status of various soil indicators among the selected agro climatic zones. The descriptive statistics pertaining to the status of various soil health indicators due to practice of organic farming over a period of time are presented in table-1.

Table 1: Descriptive statistics for soil indicators over the years

Soil indicators	Year of organic farming practices	Minimum	Maximum	Mean	SD	CV%
Organic carbon (%)	5	0.17	0.42	0.27	0.09	33.08
	10	0.26	0.69	0.42	0.13	30.93
	15	0.38	0.89	0.57	0.18	31.75
Nitrogen (kg ha^{-1})	5	80.75	199.50	136.22	45.52	33.42
	10	123.50	272.57	194.72	47.79	24.54
	15	176.70	445.00	279.53	97.19	34.77
Phosphorus (kg ha^{-1})	5	5.94	12.39	9.63	1.99	20.70
	10	10.73	20.29	14.08	3.01	21.35
	15	13.83	25.49	18.70	4.08	21.79
Potassium (kg ha^{-1})	5	98.50	155.62	131.11	19.67	15.00
	10	123.58	191.27	154.61	26.99	17.45
	15	135.67	238.46	184.55	38.62	20.92

The results revealed that, as the years of practicing organic farming increased, the status of various soil health indicators also improved. The rise in organic carbon content was from 0.27 to 0.42 per cent from fifth to tenth year, which was almost two fold. The increase was from 0.42 to 0.57 per cent from tenth to fifteenth year. Similarly the status of nitrogen also increased from 136.22 to 194.72 kg ha^{-1} from fifth to tenth year (42.9% increases). The same magnitude of enhancement was noticed between tenth to fifteenth years (194.72 to 279.53 kg ha^{-1}). The phosphorus content of the soils increased from 9.63 kg ha^{-1} during the fifth year to 14.08 kg ha^{-1} during the tenth year, an increase by 46.2 %, while during the fifteenth year the phosphorus content of the soils increased from 14.08 to 18.70 kg per hectare, an increase by 32.8%. The potassium content also increased from 131.11 to 154.61 kg per hectare from fifth to tenth year (>17.9% increase), while increase was from 154.61 to 184.55 kg per hectare from tenth to fifteenth year, an increase by 19.3%. As the frequency of organic farming practice increased, the status of the soil health indicators in this study also improved. Improvement in organic carbon, nitrogen, phosphorus and potassium contents of the soils on practicing organic farming could be attributed to increased microbial population and their activities. Increased microbial activities resulted in increased mineralization leading to increased mobilization of nutrients. These effects, however, varied among different zones. Organic farming thus resulted in improvement in soil health and indirectly in reduction in the extent of environmental degradation and supply of residue free food. These results were in agreement with the findings of Panda and Sahoo (1989), Kamalesh Kukreja *et al*. (1991), Nambiar (1995) and Bishnu *et al*. (2011).

Highly significant F- ratio presented in table -2, revealed the significant influence of years of practicing organic farming on various soil health indicators. It can be attributed to the responsiveness of zonal soils to different organic farming practices.

Table 2: Analysis of variance for over the years in selected zones

Soil indicators	Source of variation	Sum of squares	Mean sum of squares	F	SEm (±)	LSD (0.05)
Organic Carbon	Years	0.29	0.14	24.99**	**0.03**	**0.10**
	Zones	0.41	0.21	36.17**	**0.03**	**0.10**
	Interaction	0.07	0.02	3.19*	**0.04**	**0.18**
Nitrogen	Years	73338.96	36669.48	35.84**	**10.66**	**43.40**
	Zones	93457.58	46728.79	45.68**	**10.66**	**43.40**
	Interaction	18674.18	4668.54	4.56*	**18.47**	**75.17**
Phosphorus	Years	101.13	50.57	12.05**	**0.68**	**2.78**
	Zones	370.62	185.31	44.16**	**0.68**	**2.78**
	Interaction	60.33	15.08	3.59*	**1.18**	**4.81**
Potassium	Years	18077.75	9038.88	177.22**	**2.38**	**9.69**
	Zones	12911.79	6455.90	126.58**	**2.38**	**9.69**
	Interaction	1853.29	463.32	9.08**	**4.12**	**16.78**

Note: **, ** Significant at 5% and 1% level, respectively*

A keen look into fig.1 and fig. 2, there was a highest interaction between zone-1(Hilly zone) and fifteen years practicing of organic farming in case of OC (0.80%) and nitrogen (402.03 kg ha^{-1}), which may due to less sunlight, cropping systems and organic farming practices. Similarly, there was a highest interaction in phosphorus (22.88 kg ha^{-1}) and potassium (225.48 kg ha^{-1}) between zone-3(Northern dry zone) and fifteen years of practicing organic farming (Fig. 3 and 4). This might be due to the practice of bio fertilizer application soil properties and climatic conditions.

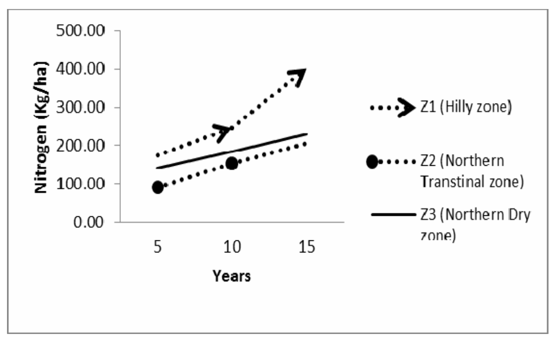

Fig. 2: Interaction between zones and years with respect to nitrogen

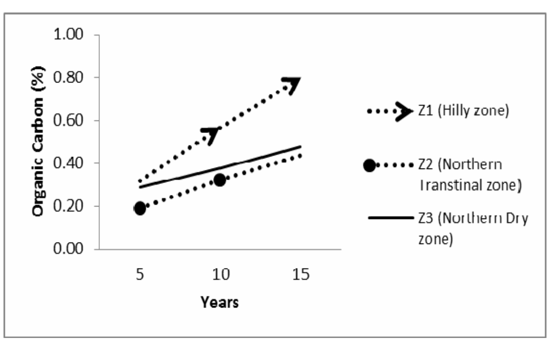

Fig. 1:Interaction between zones and years with respect to organic carbon

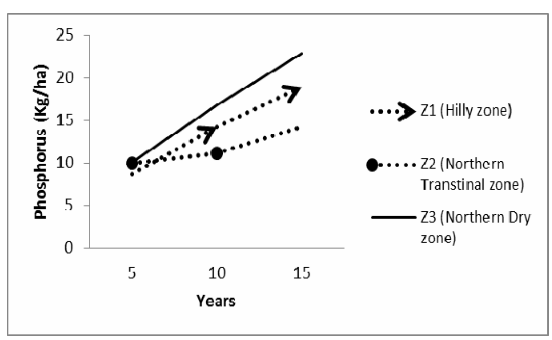

Fig. 3:Interaction between zones and years with respect to phosphorus

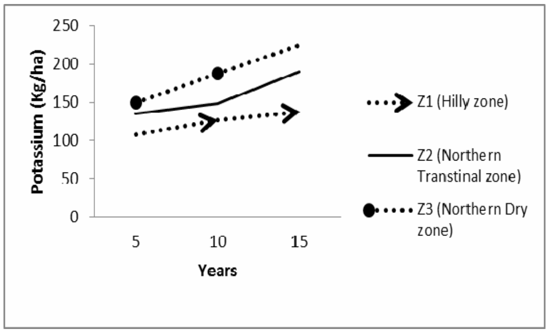

Fig 4:Interaction between zones and years with respect to potassium

The results have clearly revealed the significant impact of years of practicing organic farming on the status of various soil indicators. Thus it can be concluded that, by practicing organic farming over a period of fifteen and odd years the mounting demand of consumers for quality food can be met without disturbing environmental and ecological stability.

REFERENCES

Anonymous 2010. Organic agriculture worldwide. *Agri Exp. Adv*., **14**: 1-7.

Avery, A. 2007. *Growing organic crops and soils*. *American. Soc. Agron. Madison*, **40**:8-12

Behera, K.K., Alam, A., Vats, S. and Sharma, V. 2012. Organic farming history and techniques. agro ecology and strategies for climate change, *Sust. Agri. Rev*., **8**: 287-28.

Biao, X. X., Wang, Z., Ding, and Yang, Y. 2003. Critical impact assessment of organic agriculture. *J. Agric. Envir. Ethics*., **16**:297-311.

Bishnu, A., Bhattacharya, P., Tripathi, S., Chakraborty, A. and Saha, T. 2011. Studies on the influence of organic and inorganic inputs on soil biological parameters in Darjeeling tea gardens. *J. Crop and Weed*, **7**:55-58.

Galantini, J. and Rosell, R. 2006. Long-term fertilization effects on soil organic matter quality and dynamics under different production systems in semiarid Pampean soils. *Soil and Tillage Res.*, **87**: 72-79.

Gosling, P. and Shepherd, M. 2005. Long-term changes in soil fertility in organic arable farming systems in England, with particular reference to phosphorus and potassium. *Agric. Ecosyst. Envir.*, **105**: 425-432.

Greenland, D. 2000. Effects on soils and plant nutrition. *In. Shades of Green-A Review of UK Farming Systems* (Ed. Tinker, P.B.), Royal Agril. Soc. England, Warwickshire, pp. 6–20.

Gursharan, S. K. 2013. Organic farming in India-a viable alternative. http:// www.organicfacts. net /organic- cultivation /organic - farming-in- india- a- viable-alternative.html, retrieved on 21-04-2013.

Kamalesh, K. M., Mishra, M., Dhanakar, S. S., Kapur, K. K. and Gupta, A. P. 1991. Effect of long-term manurial application on microbial biomass. *J. Indian Soc. Soil Sci.*, **39**: 685-87.

Loes, A. K. and Ogaard, A. F. 2001. Long term changes in extractable soil phosphorus (P) in organic dairy farming systems. *Pl. Soil*., **237**: 321-32.

Lotter, D. W. 2003. Organic agriculture. *J. Sust. Agric.*, **21**: 59-28.

Nambiar, K. K. M. 1995. Major cropping systems in India, In Agricultural sustainability, economic, Environmental and Statistical considerations. *Fert. News*, pp.133-70.

Nguyen, M. L., Haynes, R. J. and Goh, K. M. 1995. Nutrient budgets and status in three pairs of conventional and alternative mixed cropping farms in Canterbury New Zealand. *Agric. Ecosyst. Env*., **52**: 149-62.

Panda, N. and Sahoo, D. 1989. Long term effects of manure and fertilizers in rice-based cropping. Systems in sub-humid lateritic soils. *Fert. News*, pp. 39-44.

Stockdale, E. A., Lampkin, N. H., Hovi, M., Keatinge, R., Lennartsson, E. K. M., Macdonald, D.W., Padel, S., Tattersall, F. H., Wolfe, M. S. and Watson, C. A. 2001. Agronomic and environmental implications of organic farming systems. *Adv. Agron*., **70**: 261-25.

Yadav, A. K. 2009. The world of organic agriculture in India, *Org. Farm. Newslet*., **5**: 2-9.

Yussefi, M. 2006. Organic farming worldwide : overview and main statistics. *In. The world of Organic Agriculture, Statistics and Emerging Trends* (Eds. Willer, H. and Yussefi, M.), Int. Fed. Org. Agric. Mov. (IFOAM), Bonn Germany and Research Institute of organic agriculture (FiBL), Frick, Switzerland. pp. 23-37.